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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/593,137	09/18/2006	Hikaru Okubo	033036.110	6494
441 7590 03/09/2011				
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EXAMINER				
FINK, BRIEANN R				
ART UNIT		PAPER NUMBER		
1763				
MAIL DATE		DELIVERY MODE		
03/09/2011		PAPER		

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

### Office Action Summary

**Application No.**

10/593,137

**Applicant(s)**

OKUBO ET AL.

**Examiner**

Briann R. Fink

**Art Unit**

1763

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 24 November 2010.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-41 is/are pending in the application.
- 4a) Of the above claim(s) 1-13, 15-22 and 26-41 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 14 and 23-25 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-945)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

### DETAILED ACTION

1. This office action follows a reply filed on November 24, 2010. Claims 14 and 23 have been amended. Claims 14 and 23-25 are currently pending and under examination.
2. All previous rejections are withdrawn, as applicants have amended to include the particle size of the silver powder and have limited the Compound (D) to where  $X^3$  is limited to  $-O-$ .
3. The declaration under 37 CFR 1.132 filed November 24, 2010 is insufficient to overcome the rejection based upon *Herr* in view of *Sakurai* (now further in view of *Chan*) as set forth in the last Office action because: the declaration only compares the bis-maleimides of *Herr*; however, the examiner suggested the substitution of the bis-maleimides of *Herr* for those of *Sakurai*.
4. The texts of those sections of Title 35 U.S. Code are not included in this section and can be found in a prior Office action.

### ***Claim Rejections - 35 USC § 112***

5. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

6. Claims 14 and 23-25 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to

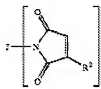
one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Applicants now claim silver powder (A) "having an average particle diameter of..." in instant claims 14 and 23. The specification only ever describes the particles as having "an average particle size" (see instant specification, pp. 15, 42 and 47). Applicants do not have basis for claiming the particles as having the claimed "particle diameter", as applicants only have basis for claimed the "particle size".

### ***Claim Rejections - 35 USC § 103***

7. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over *Forray* (US 2004/0102566) in view of *Sakurai* (JP 2003-040939). However, for convenience, the machine translated English equivalent will be cited below.

*Forray* teaches a die attach adhesive comprising a maleimide of the following:

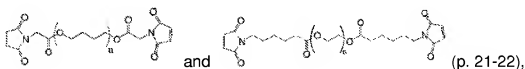


, where m is 1-15, R<sup>2</sup> is H or a lower alkyl, and J is a mono- or polyvalent radical selected from hydrocarbyl, hydrocarbylene, and combinations of one or more linkers which include —O— and —OC(O)—, describing these groups as oxyalkylene, carboxylalkylene, etc. (p. 2, [0025], [0034]-[0036]). *Forray* also teaches the inclusion of vinyl ethers, specifically listing

poly(tetrahydrofuran)divinyl ether and tetraethylene glycol divinyl ether (p. 6, [0126]), both of which fall within applicants' claimed Compound (D). *Forray* teaches the inclusion of a heat cure catalyst which may be a free radical catalyst, such as a peroxide, azo compound, and combinations thereof (p. 7, [0139]-[0140]). Further, *Forray* teaches the addition of electrically conductive fillers, specifically listing silver, and teaching the filler as having a size of about 20 microns (p. 9, 0158]).

*Forray* broadly teaches the claimed bis-maleimides; however, does not specifically teach the claimed bis-maleimides.

*Sakurai* teaches adhesives which are prepared without a photopolymerization initiator which do not yellow in the presence of sunlight, do not crack due to further progression of a photoinitiator and are capable of incorporating low amounts of maleimide derivative while maintaining a high degree of crosslinking (p. 3, [0009] and p. 19, [0108]). *Sakurai* specifically teaches the bis-maleimide derivatives to include



both of which fall within applicants' claimed maleimides.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used the maleimide derivatives of *Sakurai* in the adhesives of *Forray* as they are taught to allow for a high degree

of crosslinking without cracking and yellowing of the composition, and they are clearly enclosed by the broad teaching of *Forrey*, as described above.

Also note *Sakurai* teaches the inclusion of a thermal initiator (p. 16, [0085]). *Forray* teaches the optional addition of a photoinitiator; however, using the maleimides of *Sakurai* would motivate one of ordinary skill in the art to exclude the photoinitiator.

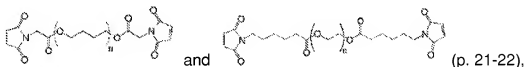
8. Claims 23-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Herr* (US 6,265,530) in view of *Sakurai* (JP 2003-040939) and further in view of *Chan* (US 5,006,575). However, for convenience, the machine translated English equivalent will be cited below.

*Herr* teaches an adhesive for use in semiconductors which comprise a maleimide compound, a vinyl compound, a curing initiator, and optionally, a filler (col. 1, ll. 43-49).

*Herr* teaches the maleimide compounds to have a structure represented by  $[M-X_m]_n-Q$ . M is a maleimide moiety. When  $m$  is 0,  $n$  is 2, and Q is an ester of  $-R^3-C(O)O-R^3-O(CO)-R^3-$ , and  $R^3$  is an alkyl or alkyloxy, the bis-maleimides are similar to those of the instant invention; however, *Herr* fails to explicitly teach the claimed bismaleimides, when the 'middle'  $R^3$  is that of a polyether.

*Sakurai* teaches adhesives which are prepared without a photopolymerization initiator which do not yellow in the presence of sunlight, do not crack due to further progression of a photoinitiator and are capable of

incorporating low amounts of maleimide derivative while maintaining a high degree of crosslinking (p. 3, [0009] and p. 19, [0108]). *Sakurai* teaches the maleimide derivatives to include



both of which fall within applicants' claimed maleimides.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used the maleimide derivatives of *Sakurai* in the adhesives of *Herr* as they are taught to allow for a high degree of crosslinking without cracking and yellowing of the hardened composition.

As to the vinyl compounds, *Herr* discloses them as having the structure  $[R_1-CH=CHR_2-B-X_m]_n-Q$ . When  $R_1$  and  $R_2$  are H, B is  $CH_2$ ,  $m$  is 0,  $n$  is 2, and Q is  $-R_3-OC(O)-R_3-(CO)O-R_3-[-OC(O)-R_3-(CO)O-R_3-]_p-$ , and  $R_3$  can be independently an alkyl or alkyloxy group, the allyl esters of (G) are obtained.

*Herr* teaches the curing initiator to be that of a free-radical initiator, such as peroxides, including dicumyl peroxide (col. 2, ll. 44-16). Note this is the same initiator used in the examples of the instant invention (see instant specification, Examples E1-E3, p. 67). *Sakurai* also teaches the inclusion of a thermal initiator, specifically peroxides (p. 16, [0085]).

*Herr* teaches the fillers to include silver, as well as copper, gold, silica and alumina (col. 3, ll. 14-18).

*Herr* exemplifies the inclusion of SF-96 silver flakes; however, fails to specifically teach the size of the flakes.

*Chan* teaches die attach adhesive compositions teaching that silver particles are widely used in the electronics industry for the manufacture of film pastes, further teaching that the conductivity of circuits prepared from the pastes can be substantially improved by the use of flake silver particles (col. 2, ll. 45-64). *Chan* teaches that the flake silver is used to get a higher degree of electrical and heat conduction when having a size of between 10-30  $\mu\text{m}$  as this allows for relatively low silver loading (col. 3, ll. 22-30).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have chosen a silver filler in the semiconductor adhesive of *Herr* having a size of between 10-30  $\mu\text{m}$  as taught by *Chan* because it allows for low loading of the filler with a higher degree of electrical and heat conduction.

Note *Herr* teaches an alternative of incorporating both thermal and photo-initiators. Using the maleimides of *Sakurai* would motivate one of ordinary skill in the art to not use a photoinitiator.

### ***Response to Arguments***

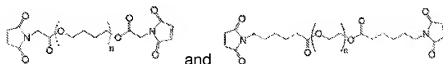
9. Applicant's arguments filed November 24, 2010 have been fully considered but they are not persuasive.



a. Applicants argue that *Sakurai* teaches utility which is different than the instant invention and there is a lack of teaching of the claimed maleimides, further arguing the presence of a photoinitiator.

Firstly, *Sakurai* specifically teaches the composition as being useful for adhesives (p. 2, [0001] and p. 19, [0108]). The claimed adhesive "used for bonding a semiconductor chip or a heat dissipating member" is a future intended use and does not limit the composition.

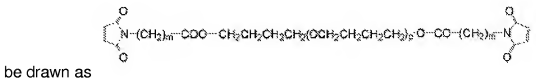
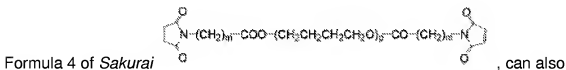
Secondly, *Sakurai* specifically draw out the bis-maleimides and exemplify, as shown above and again as follows:



and

(p. 21-22). These

compounds are CLEARLY polyethers. It is not clear as to why applicants believe the compounds of Formulas 3 and 4 do not meet the instant invention. Perhaps



which can be seen more easily to match up with the claimed bis-maleimides, when the polyether R6 of the instant invention is a 4 carbon hydrocarbon.

Thirdly, *Sakurai* specifically discloses the composition as being "hardened by the ultraviolet radiation of the practical amount of exposure **excluding a**

**photopolymerization initiator**" (p. 2, [0001] and p. 29, [0159]). *Sakurai* does prefer the inclusion of a small amount of photoinitiator; however, it is not mandatory but rather optional. Also, because one of ordinary skill in the art learns from *Sakurai* that the polymerization can occur in the absence of a photoinitiator, one of ordinary skill in the art would be motivated to carry out the thermal free radical polymerization of *Herr* without a photoinitiator.

b. Applicants further argue that there is no motivation to substitute the bis-maleimides of *Sakurai* with those of *Herr*.

The examiner disagrees, as *Sakurai* suggests the exclusion of a photoinitiator, allowing for decreased yellowing and cracking, and an increase in crosslinking (p. 3, [0009]).

c. The declaration under 37 CFR 1.132 filed November 24, 2010 is insufficient to overcome the rejection based upon *Herr* in view of *Sakurai* as set forth in the last Office action because applicants simply carried out their own compositions using the bis-maleimides of *Herr*. This was not suggested by the examiner, but rather the substitutions of the bis-maleimides of *Herr* for those of *Sakurai* were suggested. Further, *Sakurai* teaches a decrease in the cracking when using the bis-maleimides described above; therefore, one of ordinary skill in the art would expect an increase in solder crack resistance using the bis-maleimides of *Sakurai*.

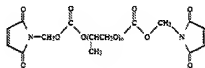
In order to overcome the current rejection of *Herr* in view of *Sakurai*, applicants would need to show that the instant invention shows unexpected results versus the compositions of *Herr* when incorporating the bis-maleimides of *Sakurai*.

- d. Applicants argue when B=C for *Herr*, arguing that C does not incorporate CH<sub>2</sub>.

One of ordinary skill in the art would construe "C" to be "CH<sub>2</sub>", such that if B were truly "C", the suggested compound could not exist.

### ***Conclusion***

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.



- a. US 4,675,414 teaches
- b. US 7,081,486 teaches photopolymerizable compositions comprising a polyether bismaleimide acetate.
- c. US 7,160,946 teaches a die attach adhesive comprising a liquid curable resin comprising an aromatic bis-maleimides resin powder, a maleimide liquid resin, polymerized with vinyl ethers and in the presence of a filler

- d. US 7,026,370 teaches the claimed bis-maleimides polymerized in emulsion; however, fails to teach the inclusion of a thermal initiator and silver powder.

***Conclusion***

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Briann R. Fink whose telephone number is (571)270-7344. The examiner can normally be reached on Monday through Friday, 7:00 AM to 4:30 PM (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Milton I. Cano can be reached on (571)272-1398. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Milton I. Cano/  
Supervisory Patent Examiner, Art Unit 1763

/Brieann R Fink/  
Examiner, Art Unit 1763